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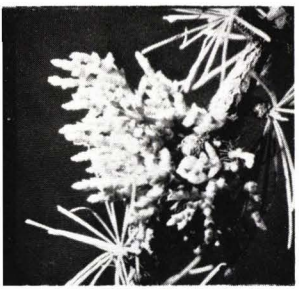

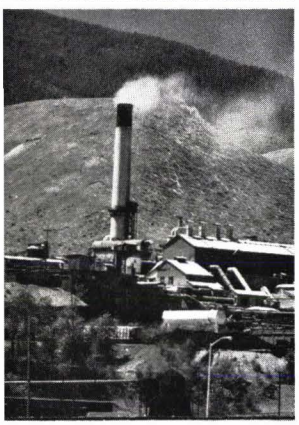

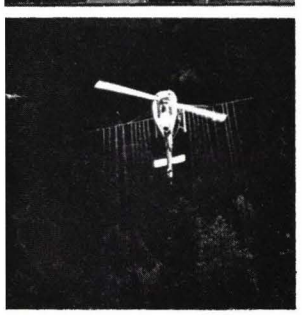

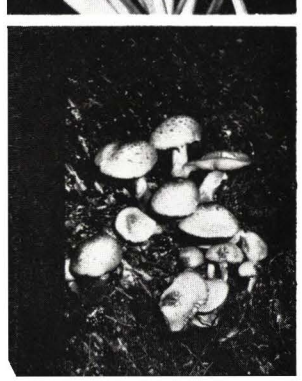

FOREST INSECT & DISEASE MANAGEMENT

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STATUS OF MOUNTAIN PINE BEETLE INFESTATIONS IN SECOND-GROWTH PONDEROSA PINE STANDS LITTLE ROCKY MOUNTAINS, FORT BELKNAP RESERVATION, MONTANA 1977

by

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ABSTRACT

Mountain pine beetle infestations in second-growth ponderosa pine developed in 1973 in the Little Rocky Mountains. In 1976, increasing numbers of attacked trees were observed. Current infestation intensity averages 7.1 trees per acre. Losses are expected to continue as long as stands remain overstocked and stagnated. Reduction of basal area by commercial sales and/or thinning is recommended. Precautions are given to prevent population buildup of secondary bark beetles.

INTRODUCTION

The mountain pine beetle (*Dendroctonus ponderosae* Hopk.) is a serious pest of second-growth ponderosa pine (*Pinus ponderosa* Laws.) throughout the western United States (Dolph 1966; Keen 1952). Outbreaks frequently occur in overstocked 60- to 80-year-old, stagnated stands. Tree killing is indiscriminate with trees of all diameter classes above 5 inches diameter at breast height (d.b.h.) attacked. Infestations usually reach epidemic levels rapidly and continue for several years before declining. In the early years of an outbreak, about 5 to 10 trees per acre are killed and group kills of 3 to 5 trees are common. Subsequently, number of infested trees increases to a peak of about 30 to 150 trees per acre per year in 3 to 5 years, then declines. Within a stand, the duration of an outbreak from onset through collapse is generally 6 to 8 years. Progressive infestations through time promote natural conversion to other climax types through ecological succession (Eaton 1941).

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ROCKY MOUNTAIN STATION

Infestations developed in the Little Rocky Mountains (figure 1) on Bureau of Land Management and Bureau of Indian Affairs lands in 1973. Population buildup was noted when 75 fading ponderosa pines were found in the Landusky campground in March 1976. In May an additional 87 infested trees averaging 13.1 inches d.b.h. were located in Bear Gulch. Of these beetle-killed trees 6 were attacked in 1973, 10 in 1974, and 71 in 1975. This represents a 1:7 buildup ratio from 1974 to 1975.

In 1977, aerial detection surveys of the Little Rocky Mountains indicated increased bark beetle buildup. As a result of these increases, the Bureau of Indian Affairs, Fort Belknap Reservation, requested a biological evaluation of the area. Ground surveys were conducted to determine infestation trend and tree and volume losses.

METHODS

Variable plot cruises using a basal area factor of 20 were conducted on approximately 300 acres in Bear Gulch. Plots were located at 5-chain intervals on cruise lines 5 chains apart. A total of 137 plots were established. Trees 5 inches or greater d.b.h. within plots were recorded by species, d.b.h., and height, then categorized into the following classes:

0 = green, uninfested

1 = unknown mortality

2 = 1977 attack; green or partially faded foliage, bark beetle brood and blue stain present

3 = 1976 attack; red foliage, brood emerged

4 = 1975 or prior attack; majority of needles dropped

5 = unsuccessful attack or pitchout; green foliage and pitchtubes present; blue stain absent

6 = secondary or other bark beetle attack

Data were analyzed using a R-1 forest insect and disease damage survey computer program (Bousfield, In Press).

RESULTS

In Bear Gulch, stand composition is 71.3 percent ponderosa pine, 18.4 percent aspen (*Populus tremuloides* Michx.); 6.2 percent lodgepole pine (*Pinus contorta* var. *latifolia* Engelm.); 3.5 percent Douglas-fir (*Pseudotsuga menziesii* Mirb.); and 0.6 percent birch (*Betula occidentalis* Hook).

The mountain pine beetle killed an estimated 4,560 trees containing a volume of 94,710 board feet during the period 1975-77.

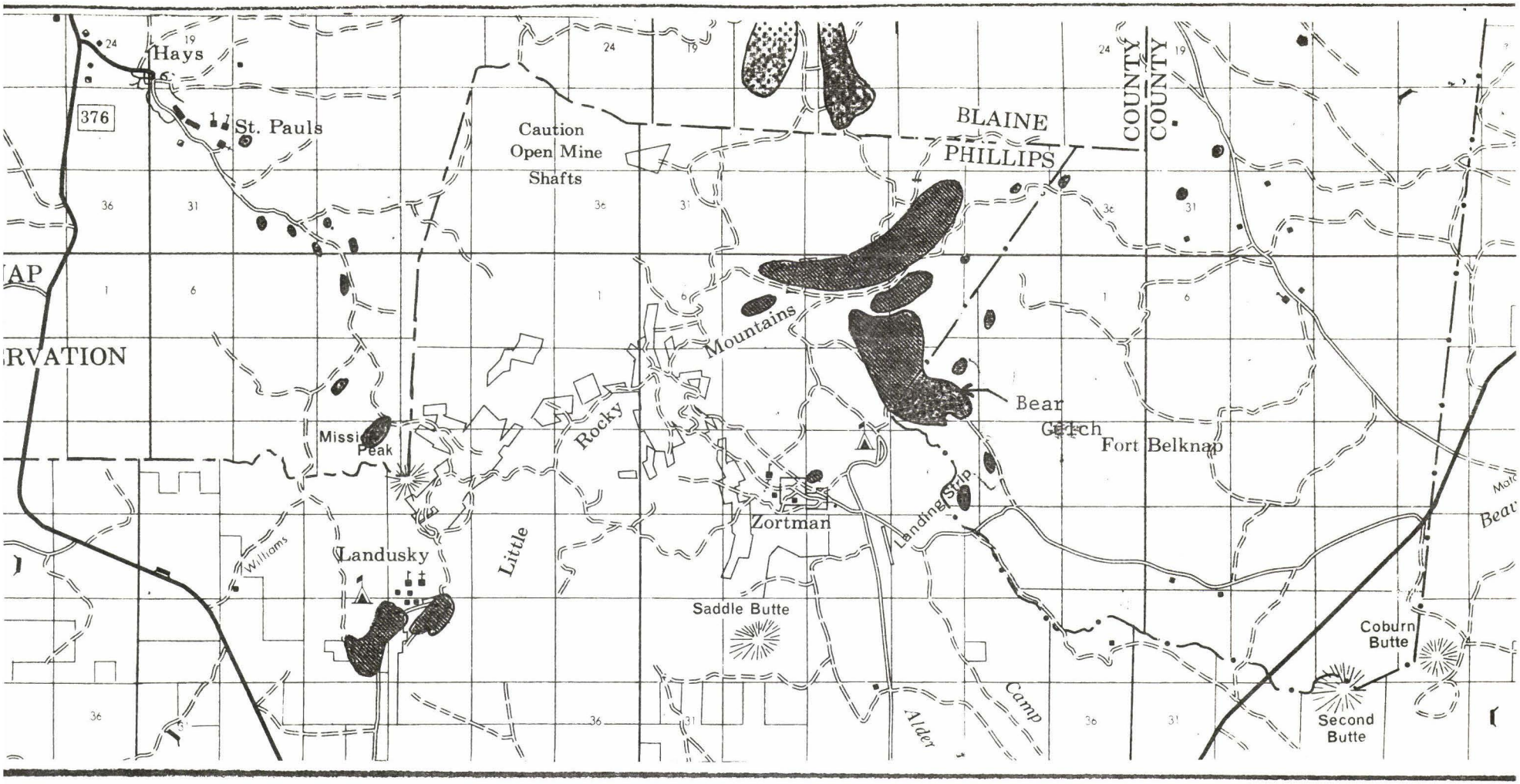

Figure 1.--Mountain pine beetle infestation, Little Rocky Mountains, Montana, 1977

Infestation on Bureau of Indian Affairs land, Fort Belknap Reservation

Infestation on Bureau of Land Management land

Reservation boundary lines

Buildup ratio of old to new attacked trees was 1:2.4 from 1975 to 1976 and 1:1.2 from 1976 to 1977. Number of trees killed per acre increased from 2.4 in 1975 to 5.7 in 1976 and 7.1 in 1977 (table 1).

Table 1.--Estimated tree and volume losses to mountain pine beetle in second-growth ponderosa pine, Bear Gulch, Fort Belknap Reservation, Montana, 1977

Diameter class (in.)	Stand parameter	Beetle attacks				Green stand
		1977	1976	1975	Unsuccessful	
0-4.9	Trees/acre	0	0	0	0	294.8
	Basal area	0	0	0	0	15.4
	Bd. ft./acre	0	0	0	0	0
5-11.9	Trees/acre	6.5	4.4	2.2	1.0	224.1
	Basal area	3.1	1.9	.8	.2	70.9
	Bd. ft./acre	43.3	34.2	5.5	0	416.6
12+	Trees/acre	.6	1.3	.2	.8	36.3
	Basal area	.8	1.6	.3	.9	43.6
	Bd. ft./acre	65.9	133.7	33.1	75.7	3,537.2
Total	Trees/acre	7.1	5.7	2.4	1.8	555.2
	Basal area	3.9	3.5	1.1	1.1	129.9
	Bd. ft./acre	109.2	167.9	38.6	75.7	3,953.8

Size of trees infested averaged 10.9 inches d.b.h. in 1977. The 5- to 11.9-inch d.b.h. size class was most heavily attacked with 6.5 attacked trees per acre.

Less than 1 percent of the ponderosa pine stand has been killed during the period 1975-77; this represents 7.3 percent of the ponderosa pine volume in the stand.

Stand basal area prior to beetle infestation was 141 $ft.^2$ per acre. Following 3 years of infestation, the beetle has reduced basal area to 130 $ft.^2$ per acre.

DISCUSSION

Outbreaks of mountain pine beetle in ponderosa pine stands are related to the following stand conditions (Sartwell and Stevens 1975):

1. Species composition: pure or nearly pure.
2. Stand structure: essentially even aged.
3. Stand age: 50 to 100 years.
4. Tree size: 8 to 12 inches d.b.h.
5. Stand density: stem basal area in excess of 150 $ft.^2$ per acre.

Infestations in Bear Gulch generally conform to all these criteria. Stand composition is largely ponderosa pine (71 percent), stand structure is generally even aged (>100 years) with some large overstory trees (>200 years), tree size averages >10.5 inches d.b.h., and stand density as measured by stem basal area approaches the critical limit of 150 $ft.^2$ per acre.

Overstocked ponderosa pine stands are highly susceptible to attack by mountain pine beetle (Sartwell 1971). The relationship of beetle-caused mortality to stand density is believed to occur because overcrowding reduces tree vigor, allowing beetles to kill a larger proportion of trees in a dense stand than in a sparse one.

Griffin (1975) found that thinning ponderosa pine affected stands in several ways:

1. Beetle-caused tree mortality was significantly reduced

2. Growing conditions for residual trees were improved with lower stand densities

3. Uninfested portions of thinned stands are less likely to become infested in the future.

Similar results have been reported for other stands in Oregon and Montana (Sartwell 1971; Sartwell and Stevens 1975; Stage 1958).

RECOMMENDATIONS

Data indicate the most viable option for managing second-growth ponderosa pine stands to prevent mountain pine beetle outbreaks or reduce mortality is commercial thinning. At least 16-foot spacing between trees should exist. Sales to open stands by removing infested trees, leaving a mixed species composition, are encouraged and should be continued in Bear Gulch. Unmerchantable infested trees should be skidded to central landings and burned prior to beetle emergence (July). These management practices will increase stand vigor and reduce and/or prevent incidence of mountain pine beetle attack.

Damage to trees by secondary bark beetles (e.g., *Ips* spp.) associated with thinning and logging slash can be minimized by:

1. Providing a constant supply of green slash from April through September.

2. Thinning large areas by progressively thinning blocks of $\pm$ 10 acres during summer months.

3. Piling and burning infested slash when thinning is completed.

Avoid scorching standing trees when burning slash. Scorched trees are

weakened and susceptible to attack by the red turpentine beetle (*Dendroctonus valens* Lec.) as well as *Ips* spp. If weather prevents slash burning, infested unmerchantable trees can be chipped. Slash <3 inches in diameter requires less attention since it dries rapidly and prevents brood development. Slash exposed to direct sunlight dries faster than shaded slash, thus causing brood mortality.

In logging and thinning areas, leaving logs decked until they become infested with *Ips* then transporting them for processing will reduce beetle populations. At mill sites, process logs and burn slash prior to beetle emergence to prevent infestation of adjacent forests.

A coordinated effort between the Bureau of Indian Affairs and the Bureau of Land Management utilizing these practices will improve stand conditions in the Little Rocky Mountains and should reduce mountain pine beetle populations to tolerable levels. Secondary bark beetle population buildups should be prevented.

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